LIMITED CIRCULATION

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Agricultural Memorandum No: 1018

Shelter for Sheep by J R Starr

Summary

This Memorandum is a draft for a Ministry of Agriculture, Fisheries and Food 'Leaflet' of the same title, requested by ADAS Livestock Husbandry and Environmental Specialists.

The text has the following sub-headings:

The need for shelter - exposed areas, effects on productivity and health.

Flock behaviour - response of flock to wind, temperature, snow; rôle of the shepherd.

Forms and Functions of Shelter - definitions, classifications, extent of shelter, effect of landform and nature of surface, valley shelter, 'stells'.

Shelter and Land Husbandry - effect on grass production, growing and grazing season, wintering at home, livestock versus crop husbandry shelter.

Disadvantages of Shelter

Design and Siting - Belts and 'blocks', relationship to land-form, establishment, low-level cover, ' networks ', amenity and timber potential.

Selection of tree species and woodland composition - limitations imposed by soil and proximity of coast.

Artificial windbreaks for sheep housing, paddocks and elsewhere - stone walls, 'stells', plastic materials, hessian, straw bales.

Publications Consulted

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SHELTER FOR SHEEP

The need for shelter

Even in the temperate British climate, sheep and lambs can suffer grieviously; indeed even in an 'average' year nearly 1 million lambs succumb to exposure or starvation. Lambs exposed to the elements have a lower growth rate; the exposed, pregnant ewe tends to lose, typically, 8 to 20% of its weight when quantity and quality of herbage are low and to produce less lambs per ewe.

The need for shelter for Livestock mainly concerns farms in upland or mountainous and other 'exposure' prone areas. Problems are particularly acute for hill sheep spending winter on exposed grazings of poor nutritive value although breeds of sheep differ in their reaction to climatic stress and thus in their shelter needs. Although cold, driving rain may fail to disturb the composure of the Welsh Black any shelter will improve the local climate and reduce metabolic requirements.

The result is:

- greater production per unit area of pasture
- available food goes further

Lack of shelter has been associated with a number of health problems in sheep and lambs:

- metabolic disorders
- twin lamb disease
- anaerobic infections
- pneumonia
- wasting disorders.

Shelter seems to offer advantages at certain susceptible stages:

adult: late pregnancy, lambing, lactation, shearing
lamb: at birth and early post-natal period (exposure/starvation syndrome), weaning.

Although there seems less need for supplementary shelter on lowland farms, where hedges and ridges generally provide shelter from the worst of the weather, the allocation of weakling stock to the better sheltered fields can pay dividends. Straw bales, too, can provide useful shelter at exposed feed areas.

Flock behaviour

Studies on hill flocks have shown that (Blackface) ewes seek shelter (or, a subtle distinction, move away from unpleasant exposures) in windspeeds over about 20 mph with shelter seeking activity increasing markedly in sub-freezing temperatures, and with rapid temperatures falls when above freezing.

It would appear that the thick fleece offers good protection against rainfall but less so against wind. When the 'cooling power' of the air exceeds a threshold a high proportion of ewes have been observed to seek shelter.

- Snow does more than interrupt food supply; the resting pregnant ewe can lose heat by contact with cold frozen ground. Snow-free woodland provides valuable shelter under these conditions. It is also within woodland in prolonged cold spells that water supplies may be found.

- While in severe weather flocks may move voluntarily to sheltered slopes; left to themselves in storms flocks may break into 'huddles' in dangerous positions.

- Good shepherding can ensure flocks are assembled at sheltered places, clear of snow, with adequate grazing and emergency supplies of supplementary feed.

- Similarly good shepherding on regulating access of flocks to shelter can offset the tendency of sheltered pastures to become exhausted and foul.

Forms and functions of shelter

Wind-breaks must rank among the earliest devices used by man to serve his agricultural needs by improving local climate conditions.

Indeed, shelter produces a number of effects on the 'microclimate' downwind such as increased soil temperatures, reduced evaporation, but shading effects and particularly reduced wind speed are the most important as far as stock are concerned.

Incidentally, the terms 'windbreaks' and 'shelter belts' are often used interchangeably; however, strictly:

- 'shelter-belt' implies a long block of single or multiple rows of trees or shrubs protecting the perimeter of a field. 'Windbreak' implies a natural or artificial shelter established either around smaller areas of land or buildings or 'internally' within larger fields.

Shelter may be classified as:

- 'Landform' (or 'Geomorphic'): due to the direction and steepness of slopes and the presence of irregularities such as small crags or gullies.

- Vegetative: provided by gorse, bracken, 'tussocky' pasture.

- Artificial: buildings, stone walls, straw bales, 'stells', manufactured windbreaks of plastic, hessian etc.

- Forest: provided by trees of any kind, its need greatest where stock has to be concentrated for management reasons.

There is plenty of practical experience to suggest that 'landform' shelter makes the greatest contribution to total available shelter over many hill and upland areas.

Wind shelter due to a 'porous' windbreak is effective for some 10 times the shelter height downwind (Fig. 1). Solid shelter such as walls and dense plantings of trees provide very effective shelter downwind but can give rise to highly turbulent gusts further away - uncomfortable for sheep, damaging to crops.

- On upland farms shelter is of more value at the foot and crest of a rise where wind concentrates.

- Behind ridges and crests may be a calm area followed by a highly turbulent zone (Fig. 2).

- Leewards slopes with gradients less than 1 in 4 or 5 lack landform shelter since wind can follow the contours and sweep down the hill.

Thus the smooth rounded profiles of the Southern upland, the Mid Wales plateaus and the undulations of down and wold offer little 'landform' shelter; broken, rocky country like Snowdonia and the Pennines offers a great deal.

Valleys channel the wind and in deeply cut Welsh Valleys, for example, high winds can result. Higher up the wind clings to the contours and the flattened crests may be as sheltered as leeward aspects so that shelter can often be established on leeward and windward edges of broad ridges.

- In the valleys the best arrangement is one where shelter belts run down the side slopes at convenient (parallel) intervals (which are generally controlled by field boundaries or pasture management). Fig 3

The most effective 'landform' shelter lies in hollows and gullies, welcome enough in ram and wind but potentially letal to sheep and lambs under conditions of drifting snow. Indeed it may be sensible to plant up such areas, extending the planting up the banks to give suitable shelter.

Since wind is slowed by its passage over rough country very low wind speeds, even in gale force winds, might be found up to $\frac{1}{2}$ metre above rough pasture; tussocky pastures, gorse and bracken thus not only slow the wind at low level but offer a degree of downwind shelter.

In years past circular stone 'stells' about 15 m in diameter, sited on lower slopes (but not in valleys) allowed access to grazing blown clear of snow, providing shelter from any wind direction for a limited number of sheep. Stells still find extensive use in parts of the Pennines and the Borders. The modern equivalent is the skilfully designed and managed woodland plantation with appropriate shape and/or access.

Shelter and land husbandry

Intensively grazed patches near shelter are manured fairly heavily, gradually forming more protein-rich grasses. Thus shelter can make a contribution to management and increased production in hill areas. Through encouraging the more efficient use of winter feed, too, shelter can be regarded as an aid to intensification.

Woodland shelter for hill paddocks allow in-bye fields to be freed early in the season.

Properly distributed shelter can extend the growing and grazing seasons and spread the benefits of re-seeding more evenly. Accessible shelter, should the weather break,

allows stock longer at higher elevations and is invaluable for sheep hefted on the hill all the year.

Movement of flocks from the hills to lower elevations is an increasingly expensive business but wintering at home calls for supplementary feeding and shelter; shelter helps by providing better growth conditions for hay and crops in upland fields.

Shelter in winter months may serve as useful summer shade. Widely dispersed trees, open woodlands, scrub and stone walls - recognised as nuisances in crop husbandry - will be an asset for stock farmers.

Disadvantages of Shelter

- Food and shelter go hand-in-hand. Scarcity of one or the other can lead to disaster amongst hill flocks in a winter blizzard.

- Shelter and supplementary feeding may make sheep less inclined to forage for themselves.

- Sheep that have been well sheltered in winter may suffer a check in a cold, windy spring leading to twin-lamb disease, for example.

- Lambs may be encouraged to remain in shelter rather than follow the ewe.

- If sheep remain too long in the lee of shelter the ground will tend to foul and the danger of worm-borne diseases increases - poaching and compacting can be a serious problem on sticky clays.

- Sheep may not be able to use shelter during severe conditions without a considerable disruption of grazing patterns. This social behaviour may thus restrict response to climatic stress and limit the value of ill-sited shelter.

- Wide shelter belts can suffer heavy snow loading damage - particularly the Scots Pine.

Design and siting

- Long sprawling shelterbelts complicate shepherding as well as being ugly. but belts can be sited so as not to interfere with the natural rake of sheep. Fenced paths through long belts may be justified

- Shelter in the form of trees or hedges should extend the natural 'landform' shelter.

- Shelter sited so that ground to leeward falls away .. gives good value.

- Multiple belts may be arranged in a 'grid' or 'checker board' pattern on uniform plains or upland slopes.

- Belts running down either side of a windswept valley at frequent intervals can transform the environment. (Fig. 3)

- Scattered 'woodland' blocks at strategic points may be more useful than a long strip on hill farms, affording protection whatever the wind direction.

Possible shapes for woodland plantations are endless although the square, Manx-leg and Maltese Cross are popular. Farms must however suit the needs of the farm and situation and usually as simply and cheaply as possible. (Fig. 4)

Access by staggered paths avoids draught-encouraging gaps. (Fig. 5)

Natural shelter can take many years to establish in adverse environments. However farmers claim that even at a very early stage the young plantation provides benefits.

Certain trees will be inappropriate for certain soil types while coastal locations require trees resistant to salt-burn.

Young trees will benefit from some initial protection either by planting in the lee of some local 'landform' shelter or by establishing temporary artificial shelter. Hedgerow or embankment offers an excellent foundation for a new shelter belt.

Uniform wind penetration over the height of a 'belt' or 'block' is favoured; an irregular canopy profile is more effective in breaking-up the air stream over the canopy. Since belts are designed to filter not deflect the wind, a 'pitched roof' cross-section is less effective in providing shelter than belts with more vertical sides. Shelter too sparse near the ground can be augmented by an 'underwood' of healthy shrubs.

To secure benefits from shelter over large areas of open-grazing calls for a shelter 'network' which may not be economic whereas a sheltered paddock or two could pay dividends.

Amenity and timber possibilities are important but it is the contribution of the shelter potential that has priority - whether in the form of long lines or compact blocks.

Selection of tree species and woodland composition

. Note trees that do well in the area on similar soils and aspects.

For a mixed shelter the basic choice should be based on:

. a species to grow fast for early shelter even if comparatively short lived

. a more permanent slow-growing species

. supplementary species tolerant of shade

. hardy, wind-firm, trees for exposed edges

. 'underwood' species for low clover (such cover, if near base of hills, must be open enough to permit 'drainage' of cold air to valley on frosty nights Fig. 6).

Advice on tree species, siting and layout is available from the Forestry Commission and MAFF Land and Water Service Advisers; ADAS Agro-meteorologists are often able to advise on certain siting and meteorological aspects.

Artificial wind-breaks for sheep housing and paddocks.

For centuries sheep have taken advantage of the limited protection afforded by the dry stone wall; the design and siting of the 'stell' is well documented.

Modern durable artificial windbreaks materials afford valuable shelter for limited areas, although firm anchoring is essential.

PVC materials, especially those with Ultra-Violet inhibiting chemicals added, have proved themselves in 'filling in' sides in open-sheep housing, in sheltering access and assembly areas and around lambing paddocks.

. Wind-breaks sheltering the open access to housing should be high enough to minimise the effect of air, accelerated over the top of the windbreak, from being deflected by structures down into the house.

. Straw bales laid out in a cross formation serve as valuable shelter in lambing and feed areas.

. Artificial windbreaks used for snow drifting and avalanche control in upland areas double as valuable shelter for sheep.

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Any comments or suggestions should be referred to the author.

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LEGEND

Fig.

1. Effect of permeable and dense windbreaks on windflow.

2. Hill sites appropriate for shelter belts.

3. Shelter for windswept valleys.

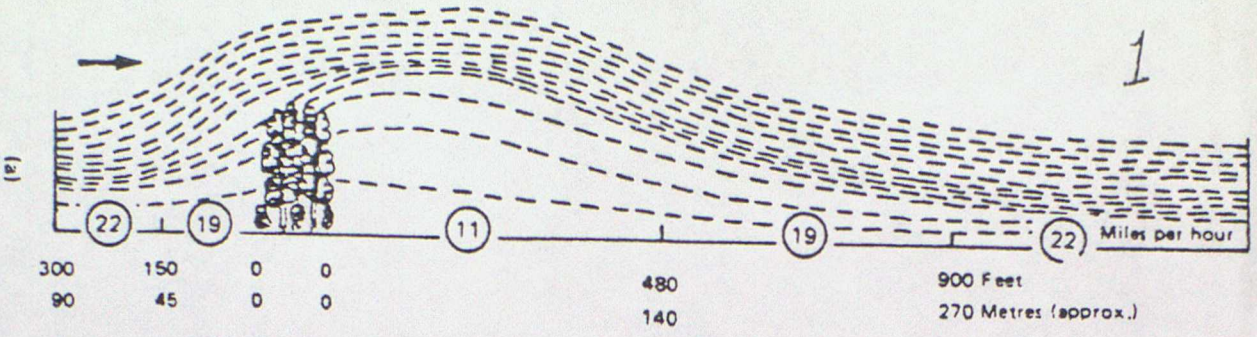
4. Woodland plantations for livestock.

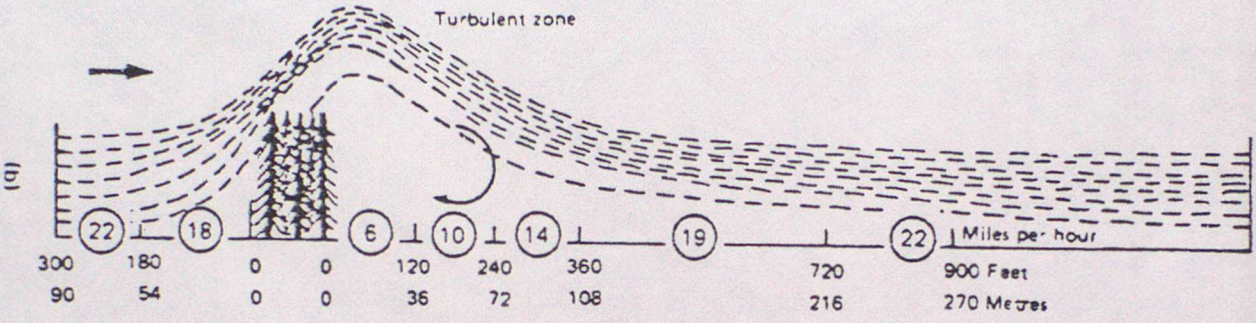
5. Access through shelter to avoid 'gaps'.

6. Frost pocket created by a dense windbreak.

(3 to 5 from Caborn, 1965).

1

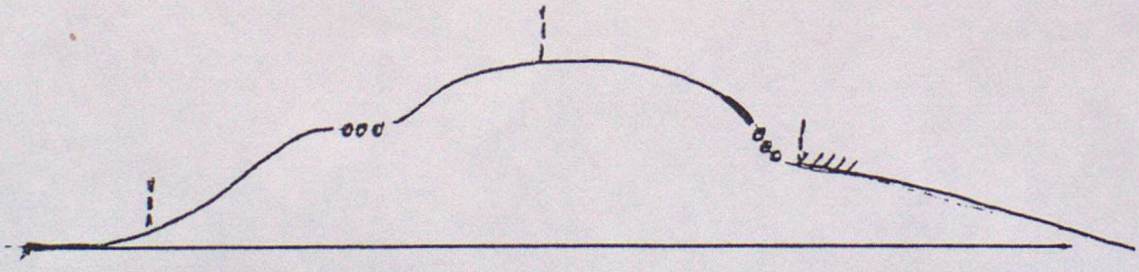




Effect of (a) moderately penetrable and (b) dense windbreaks on the flow of wind. Figures circled denote approximate wind speeds in the various sections. Horizontal distances (in metres and feet) refer to windbreaks 9m (30ft) tall *(after Kuhlewind, et al.)*

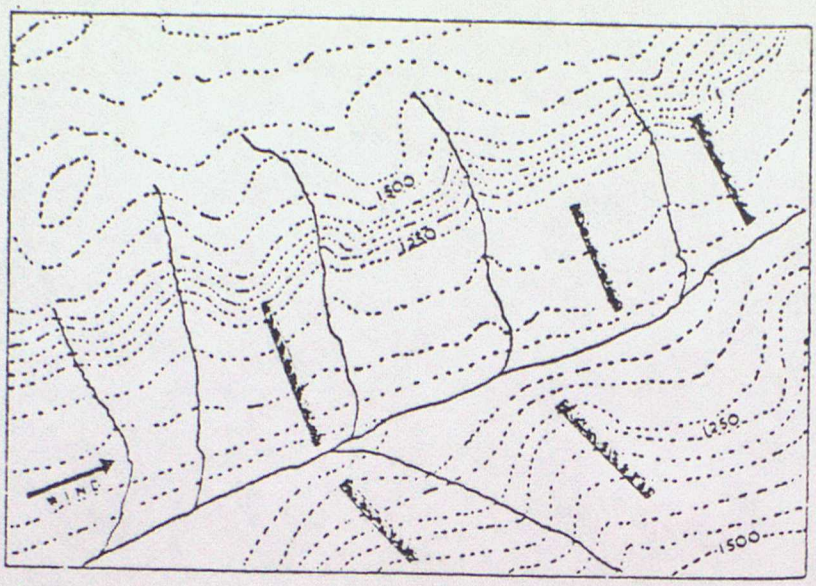
(World Meteorological Organisation Technical Notes)

2



Key 000 calm area /// turbulent area

⋮ sites appropriate for shelter belts



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Belts forming a series of 'baffle-plates' along a windswept valley.

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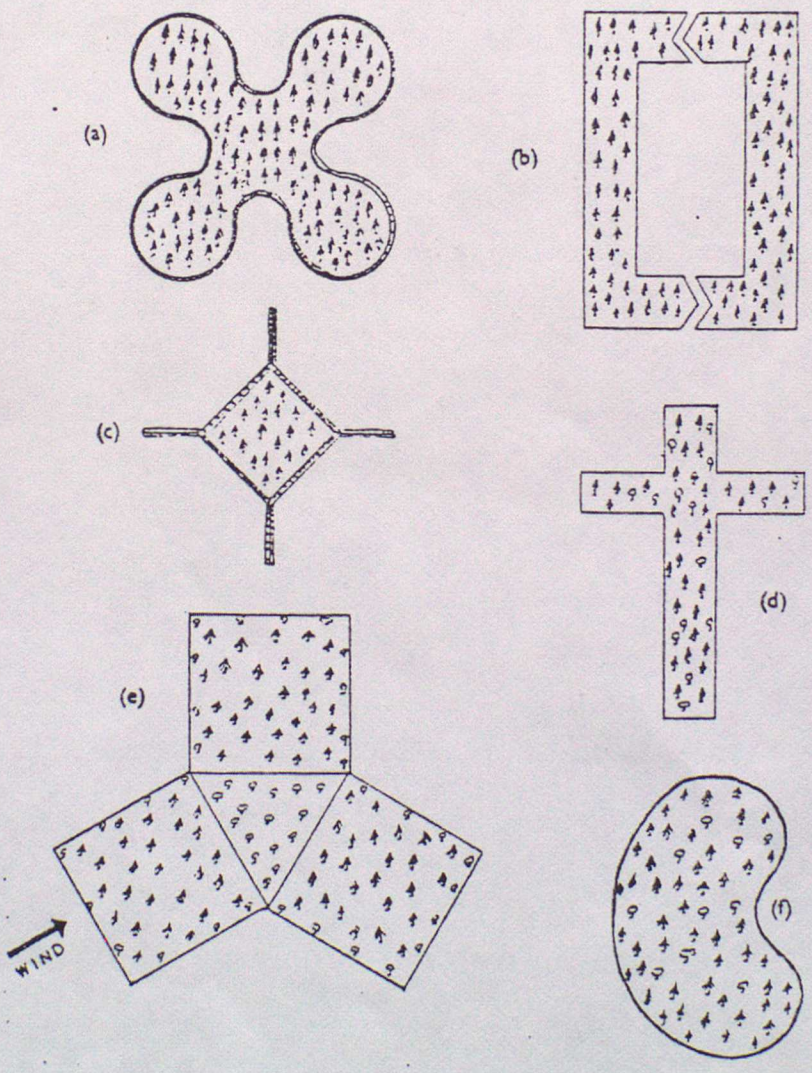
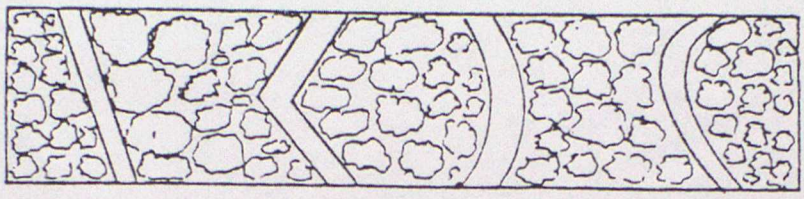


Shelter plantations for livestock. (a), (b) and (c) are nineteenth-century Scottish examples of stells combining plantations; (d) and (f) are examples of the various shapes adopted for hill planting; (e) Cadman's 'Manx-leg' plantation, affording protection against all quarters.



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Ways through cross-wind belts may be angled or curved to keep out the wind but are liable to fill with drifted snow.

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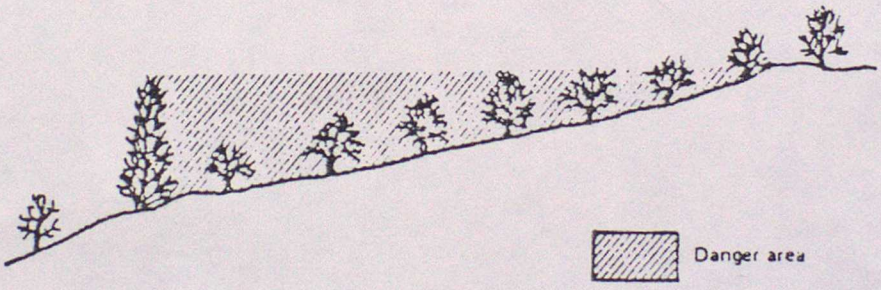

Frost pocket created by a dense windbreak